

Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Art. XI.—*Report on the Iron of Kattywar, its Comparative Value with British Metal, the Mines, and Mode of Smelting the Ore.* *By* Captain Legrand Jacob.

(*Read December* 5, 1840.)

Iron ore is found chiefly in the north-west quarter of the Peninsula. The result of my inquiries gives the number of six foundries working at one time, during the fair season, throughout the province, and two or three more occasionally. The extent to which the metal is manufactured will be given in the body of this Report. I have visited only two foundries, those at Ranawao and Ranpoor in the Ranas and Jam's Talookas respectively; but I understand a description of one applies alike to all, their construction being rude and simple.

For the Ranawao establishment, the ore is found near the villages of Bukulla, Palikhra, and Vissawarra[1]. The facility of obtaining charcoal from the Barda hills seems the only motive for fixing the foundry both there and at Ranpoor. The mineral riches of this range, or rather clump of hills, have never been developed: the iron-mines now worked are at some distance from the hills, in veins that owe their upheavement to some separate shock from the parent of the Barda cluster; and the country between the Barda and the sea, by the ferruginous nature of the soil, would seem to be rich in this ore.

The mines above specified are mere circular pits sunk into the ground to the depth of from five to twenty feet, and when a sufficiently rich portion of the vein has being gained, that portion is excavated as far as pickaxe, arm, and shovel can reach. This rude method of working the mines is, I understand, similar to that practised in the Dekhan; on being handed up to the top the ore is sifted, washed, and then despatched to the foundry in carts, or on bullocks and donkeys.

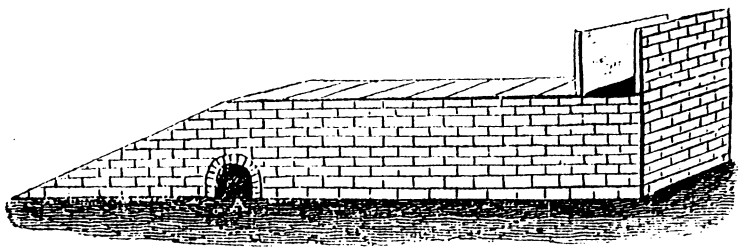
At Bukulla, the ore is met with in a ridge elevated from the general level about twenty feet; at Palikhra, in the plain close to a ridge, perhaps thirty feet high; but at Vissawarra, in the open

[1] Specimens from all three mines have been forwarded to the Secretary, Geographical Society, Bombay.

country, without any external indications; and its discovery was probably accidental by the sinking of a well for irrigation.

The smelting process is very simple: an oblong shed gives a scanty shelter to the workmen during the dry season, and during the monsoon the manufacture is suspended; the ground inside is dug away in the centre, to give room for two furnaces, which occupy the ends of the shed; they are long and narrow, to give good draught; and the masonry, or brick-work, is lined with clay, to keep in the heat; the opening for the bellows is stopped by a bit of plank protected with clay, into which fits a pipe connecting the nozzles of the two pairs of bellows; these again are stopped afresh with clay, each time the work commences.

The following rough view will illustrate the explanation; it is on the scale of half an inch to a foot, on the model of the Ranpoor furnace.



Opposite aperture A is another of like dimensions: one admits the working of the bellows, the other the escape of the scoria, for which purpose a small door is occasionally opened. The space in the furnace between the two apertures is filled with charcoal, in which beds are hollowed out for the ore, and then a fresh covering of charcoal is thrown over the whole; the ore being so deposited as to be on each side of the streams of air.

The bellows, two pair to each furnace, are formed of bullock hides sewed round bamboo hoops in vertical rings, and worked alternately by downward pressure; the person closing the mouth of the sack as he weighs upon it with his chest and arms; they throw a powerful stream of air into the furnace: in ten minutes after a small piece of lighted coal had been exposed to its action, the whole mass of ore was so thoroughly heated, that the scoria commenced exuding.

This furnace holds at a time a little more than seven Bombay muns of ore, which take from six to eight hours to smelt. The

mass is then taken out for assistant workmen to handle, and the furnace replenished. The day's work is not considered over until this process be gone through twice.

The second furnace is built up at the mouth, but otherwise resembles the first; over this the head Lohar or Smith presides. The use the workmen make of their feet would astonish a Birmingham artisan; to protect them from the scorching heat, their sandals, or rather shoes, are armed with an extra sole of ample dimensions; and during the process of manipulation, it would be difficult to say whether feet or hands are most brought into play; this applies only to the head workman, who is seated throughout the process. After the ore has gone through the first furnace, and been again heated in the next, it is split into equal portions by the wedge; and when fractured, the pieces are wrought into small bars, at the average size of four to a local mun[1]: the metal is, of course, freed from much dross by the repeated action of fire during its process through the second furnace. The iron is then ready for the market: my observations furnished me with the average of forty per cent. of iron thus obtained from the ore. Two species are manufactured: the cheapest, called *chontia*, is chiefly the iron broken into fragments by the wedge, without further manipulation than is necessary to give it some degree of shape, or it is the produce of inferior ore, and is thus sold for five cowries the mún (local); the best sort, called *marka*, fetches eight cowries.

The Ranpoor workmen informed me that the Palikhra ore, which supplied its rival foundry, was considered better than their own; the ore of Vissawarra, (a village close to Palikhra,) recently found out, is still better, and generally goes by the same name. Ranpoor is supplied from Ran, eighteen kos distant; the greater expense of carriage in the Jam's district must therefore tell in favour of the Rana's manufacture. The intelligent head Lohar at Ranpoor informed me, that with a westerly wind, they often obtained only five muns of iron a-day, and with an easterly one, seven. I was at first disposed to refer this anomaly to a difference of draught in the chimney as the east or west wind blew; but it may arise from the east wind being exceedingly dry, whilst the west, being from the sea, is moist. The Lohar accounted for it in an amusing manner. Metals, he said, were like mortals, and some climates agreed with

[1] Averaging about twenty-six Bombay rupees to the seer, and forty seers to the mun. A Ranpoor mun is equivalent to Bombay seer, rupees 26—26½.

them better than others; he further informed me, that they made more iron during the cold than during the hot weather, which he attributed to the men having their nerves better braced up for work; but this may be accounted for by the previous explanation, the east wind prevailing during the cold season, and west during the hot, though this cause cannot account for so great a difference as that mentioned by the Lohar.

The following table shows the profit accruing to the proprietor of one foundry:—

Dr.	Cowries.
Daily expense of 10 workmen, at an average rate of a cowrie each ...	10
15 mans of ore per day, or 8 baskets, at a cowrie each	8
12 baskets of charcoal, at a cowrie each	12
Daily amount of tax levied by the Nuggur Durbar	2
Average daily cost of materials...	1
Total expenses	33
Cr.	
Per average daily product of 6 local mans, sold at 8 cowries each ...	48
Deduct	33
Daily profit	15

Or nearly 5 Ahmedabad rupees.

The above is from the best information which I could obtain at the spot[1]; but the return is, I suspect, over calculated, for when sold wholesale a reduction in price is made; moreover, the metal, owing to the inferiority of ore and other causes, frequently does not rise to a higher quality than *chontia*, for which it is sold; nevertheless, considering the small risk and little outlay, a profitable return is manifest. The gradual diminution of the number of foundries in the Peninsula, gives proof of the encroachment of British iron. The master workmen receive from one and a half to two cowries a-day, according to the quantity of iron manufactured[2]. Proximity to jungle is, of course, one of the main points in fixing the site of a foundry, charcoal being the most expensive article in the manufacture.

[1] Ranpoor. The information elsewhere obtained was not full enough to rest on, but it strengthens the Ranpoor statement.

[2] This sum, it seems scarcely necessary to say, is equal to from near eight to ten annas, local currency, and may be roughly estimated at the average value of a shilling.

The workmen commence their daily toil at the first dawn of light, and cease generally a little before sunset: they appeared to labour with much perseverance and industry; it is difficult to witness, without pain, the struggles of these poor people for a subsistence, which our superior skill is yearly rendering more arduous. The annual produce of one foundry is about sixty-five Bombay khandies, or between sixteen and seventeen tons; and taking the number in the Peninsula at six constantly working through the fair season, and two or three more occasionally, the amount of iron fabricated yearly in Kattywar cannot be fixed at much above a hundred tons annually, and, may be safely estimated under 150 tons at the outside, on the supposition that foundries may exist which have escaped my notice; how insignificant is this amount compared with the exports of Great Britain[1]. Owing to the difficulty of obtaining statistical information in a barbarous country, it is possible my estimate of the number of foundries is below the real amount at work throughout the province, but all the southern parts of the Peninsula are provided with iron from Bombay, and I have not been able to discover the existence of any iron mines, much less of foundries, save in the Nuggur and Poorbunder Talookas.

The great diversity of weights, measures, and coinage, throughout the Bombay territories, is a subject of general complaint, and has supplied matter for a very learned dissertation[2]. In this Peninsula the diversity obtains not only in every Talooka, but in many of the towns and villages adjoining each other; there are

[1] About 150,000 tons yearly.

The table annexed at once shows the vast disparity of European and native skill, the augmentation of power afforded by improvements in science of late years, and the increasing magnitude of the British manufacture. It is calculated from tables published in Mc Culloch's *Dictionary of Commerce.*

	A.D.	Tons.
Produce of one foundry in Kattywar, in	1837 ...	16½
Ditto ditto in England, in	1788 ...	800
Ditto ditto ditto	1796 ...	1,033
Ditto ditto ditto	1806 ...	1,479
Ditto ditto ditto	1828 ...	2,529
Quantity of iron manufactured in Great Britain, in	1788 ...	68,000
Ditto ditto ditto	1796 ...	125,000
Ditto ditto ditto	1806 ..	250,000
Ditto ditto ditto	1828 ...	703,184

[2] Captain Jervis' work.

also various weights at the same place: for instance, Durbar weights, selling weights, and buying weights, each varying from the other several pice in the seer, and several seers in the mun; not content with this, the very scales themselves are not equipoised, but require what is termed a *pasung* for a make weight, which, it may be supposed, is made use of as little as possible. The system calls loudly for reform. The difficulty of framing a correct comparative scale from such materials as these can be understood by those who make the attempt, and who also know the inaptitude of the native mind to convey statistical intelligence of any kind. The following are the results of my calculation:—The best species of country iron is called *marka*, the inferior *chontia*. Marka is sold at a rate equivalent to 2*r*. 10*a*. 6*p*. Bombay rupees; the Bombay mun 10*r*. 10*a*. The hoonurwut, at 53½ rupees per khandy; bought in this quantity, however, it should not be fixed higher than at 50 rupees. The chontia fetches a price equal to 1*r*. 10*a*. Bombay rupees; the Bombay mun, 6½ rupees; the hoonurwut, at 32½ the khandy; or if purchased in a large quantity, about 30 rupees.

Although Kattywar possesses ample capabilities for the production of iron beyond its own wants, yet the English metal competes with it even in the very spots where it is fabricated, and totally drives it out of the market in less favoured localities; of this iron two species are imported, termed *sukaí* and *roopaí*; the price varies considerably, depending on that of the Bombay market. The first sort is often sold in different parts of the province at a less price than the best country iron, and the inferior sort, or roopaí, at even a lower rate than the chontia. Foreign iron is subject to a fixed tax, imposed at the different ports of its ingress, which at Poorbunder, Nuggur, Joria, and other bunders of the iron-producing states, often brings it up to par with the country iron, or even to a higher price; but the small demand in the province enables dealers to take advantage of a glut in the Bombay market, to stock the country at a cheaper rate than the average prices in Bombay might lead us to suppose. The sukaí, or best quality of foreign iron, is purer than its rival marka, but not so malleable. The roopaí is inferior even to the chontia, and only used for the commonest purposes. The following table gives their comparative degrees of purity; as it has been drawn up from evidence and not personal examination, I do not vouch for its correctness, but having sent specimens of these different sorts of iron to the Secretary to the Geographical Society in Bombay, its accuracy can be tested, should that gentle-

man's scientific labours permit him to turn his attention to so minute a subject of inquiry.

Foreign, English, or perhaps Swedish . .	Sukaf,	20 per cent.
	Roopaf,	35 —
Country	Marka,	25 —
	Chontia,	35 —

It will be evident from the above information, that the production of iron in Kattywar runs some risk of extirpation; its superior ductility to the foreign metal preserves it still in existence, perhaps also habit and the ignorance of the people. I leave it to more experienced persons than myself, to determine how much of this quality in the metal is to be attributed to the nature of the ore, and what may be the comparative value in the foundry, of coal and charcoal.